CLAIMS

1. A zoom optical system comprising a lens system which is arranged to provide a variable zoom setting for a beam of radiation, wherein the lens system comprises a switchable optical element having a first mode and a second mode,

characterised in that the element includes a first fluid, a second fluid and a wavefront modifier having a part through which said radiation beam is arranged to pass, wherein

in the first mode the switchable optical element has a first fluid configuration in which said part is substantially covered by the first fluid, and

in the second mode the switchable optical element has a second, different, fluid configuration in which said part is substantially covered by the second fluid

2. A zoom optical system according to claim 1, wherein the first fluid is a liquid and the second fluid is gaseous.

3. A zoom optical system according to any preceding claim, wherein the switchable optical element comprises a common first fluid electrode, a second, different, fluid electrode and a third, different, fluid electrode, wherein

in the first fluid configuration the element is arranged to provide switchable electrowetting forces by applying a first voltage across said first and second fluid electrodes, and

in the second fluid configuration the element is arranged to provide different switchable electrowetting forces by applying a second, different, voltage across said first and third fluid electrodes.

4. A zoom optical system according to any preceding claim, wherein the switchable optical element comprises a further wavefront modifier having a different part through which said radiation beam is arranged to pass, wherein

the wavefront modifier is adapted to perform a first wavefront modification and the further wavefront modifier is adapted to perform a second, different, wavefront modification which is arranged to complement the first wavefront modification.

5. A zoom optical system according to any preceding claim, wherein the wavefront modifier has a face, wherein said face is substantially spherical or aspherical, and said part is on said face.

6. A zoom optical system according to any preceding claim, wherein said lens system comprises a further switchable optical element, said further switchable optical element being arranged to operate in cooperation with said switchable optical element to provide at least part of said variable zoom setting of the lens system.

7. A zoom optical system according to any preceding claim, wherein said first lens is a fluid meniscus lens which comprises different fluids separated by a fluid meniscus having a curvature,

wherein the optical system further comprises a control system and the variable focus comprises variations in the fluid meniscus curvature, wherein the control system is arranged to control the variable focus using meniscus electrowetting forces.

8. A zoom optical system according to claim 7, wherein the fluid meniscus lens further comprises a first electrode and a second, different, electrode and the control system is arranged to apply a voltage

across said first and second meniscus electrodes to provide said meniscus electrowetting forces.

9. A zoom optical system according to any of claims 1 to 5 wherein the lens system comprises a solid lens capable of being arranged at varying spatial positions relative to the switchable optical element.

10. A zoom optical system according to any of claims 1 to 5, wherein said lens system comprises a liquid crystal lens having a varying optical power.

11. Image capturing apparatus comprising a zoom optical system according to any preceding claim, wherein with the optical system being in said first mode, the apparatus is adapted to capture an image with a first zoom setting, and with the optical system being in said second mode, said apparatus is adapted to capture an image with a second, different, zoom setting.

12. Image capturing apparatus according to claim 11, wherein said image capturing apparatus further comprises a digital zoom system arranged to introduce a digital zoom factor to an image captured in the first mode and/or an image captured in the second mode.